Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria® suspected osteomyelitis in patients with diabetes mellitus.

BIBLIOGRAPHIC SOURCE(S)

Schweitzer ME, Daffner RH, Weissman BN, Bennett DL, Blebea JS, Jacobson JA, Morrison WB, Resnik CS, Roberts CC, Rubin DA, Seeger LL, Taljanovic M, Wise JN, Payne WK, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® suspected osteomyelitis in patients with diabetes mellitus. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 7 p. [22 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Alazraki N, Dalinka MK, Berquist TH, Daffner RJ, De Smet AA, el-Khoury GY, Goergen TG, Keats TE, Manaster BJ, Newberg A, Pavlov H, Haralson RH, McCabe JB, Sartoris D. Imaging diagnosis of osteomyelitis in patients with diabetes mellitus. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):303-10. [20 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

- Diabetes mellitus
- Osteomyelitis (diabetic pedal disease)

GUIDELINE CATEGORY

Diagnosis
Evaluation
Risk Assessment

CLINICAL SPECIALTY

Endocrinology
Family Practice
Internal Medicine
Nuclear Medicine
Orthopedic Surgery
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for patients with diabetes suspected of having osteomyelitis

TARGET POPULATION

Patients with diabetes mellitus who are suspected to have osteomyelitis

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Evaluation

1. X-ray
2. Magnetic resonance imaging (MRI) with and without contrast
3. Nuclear medicine
    - Tc-99m 3-phase bone scan
    - Indium (In)-111 white blood cell (WBC) scan
    - Tc-99m sulfur colloid marrow scan
    - Fluorodeoxyglucose – positron emission tomography (FDG-PET)

4. Ultrasound (US)
5. Computed tomography (CT)

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals, and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by the Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Suspected Osteomyelitis in Patients with Diabetes Mellitus

Variant 1: Soft tissue edema without ulcer or neuroarthropathy.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary. Both are indicated.	Min
MRI foot with contrast	9	Radiographs and MRI are complementary. Both are indicated. Useful for mapping devitalized areas preoperatively. See comments regarding contrast in the text below under "Anticipated Exceptions."	None
MRI foot without contrast	9	Radiographs and MRI are complementary. Both are indicated.	None
NUC Tc-99m 3-phase bone scan and In-111 WBC scan foot	4	If MRI contraindicated	High
NUC Tc-99m 3-phase bone scan foot	1		Med
NUC In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
NUC Tc-99m 3-phase bone scan and In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
US foot	1		None
CT foot without contrast	1		Min
FDG-PET foot	1		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Ulcer with no exposed bone without neuroarthropathy.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary. Both are indicated.	Min
MRI foot with contrast	9	Radiographs and MRI are complementary. Both are indicated. Useful for mapping devitalized areas preoperatively. See comments regarding contrast in the text below under "Anticipated Exceptions."	None
MRI foot without contrast	9	Radiographs and MRI are complementary. Both are indicated.	None
NUC Tc-99m 3-phase bone scan and In-111 WBC scan foot	4	If MRI contraindicated	High
NUC Tc-99m 3-phase bone scan foot	1		Med
NUC In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
NUC Tc-99m 3-phase bone scan and In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
US foot	1		None
CT foot without contrast	1		Min
FDG-PET foot	1		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Ulcer with exposed bone without neuroarthropathy.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary. Both are indicated.	Min
MRI foot with contrast	9	Radiographs and MRI are complementary. Both are indicated. Useful for mapping devitalized areas preoperatively. See comments regarding contrast in the text below under "Anticipated Exceptions."	None
MRI foot without contrast	9	Radiographs and MRI are complementary. Both are indicated.	None
NUC Tc-99m 3-phase bone scan and In-111 WBC scan foot	4	If MRI contraindicated	High
NUC Tc-99m 3-phase bone scan foot	1		Med
NUC In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
NUC Tc-99m 3-phase bone scan and In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
US foot	1		None
CT foot without contrast	1		Min
FDG-PET foot	1		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Neuropathy without ulcer

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary. Both are indicated.	Min
MRI foot with contrast	9	Radiographs and MRI are complementary. Both are indicated. See comments regarding contrast in text under "Anticipated Exceptions."	None
MRI foot without contrast	9	Radiographs and MRI are complementary. Both are indicated.	None
CT foot without contrast	5	For neuropathy or if MRI contraindicated.	Min
NUC Tc-99m 3-phase bone scan foot	5	Useful for pre-radiographic findings of neuropathy. Also if MRI contraindicated.	Med
NUC Tc-99m 3-phase bone scan and In-111 WBC scan foot	2		High
NUC In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
NUC Tc-99m 3-phase bone scan and In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
US foot	1		None
FDG-PET foot	1		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Neuroarthropathy with ulcer without exposed bone.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary. Both are indicated.	Min
MRI foot with contrast	9	Radiographs and MRI are complementary. Both are indicated. See comments regarding contrast in the text below under "Anticipated Exceptions."	None
MRI foot without contrast	9	Radiographs and MRI are complementary. Both are indicated.	None
NUC Tc-99m 3-phase bone scan and In-111 WBC scan foot	4	If MRI contraindicated	High
NUC Tc-99m 3-phase bone scan foot	1		Med
NUC In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
NUC Tc-99m 3-phase bone scan and In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
CT foot without contrast	1		Min
US foot	1		None
FDG-PET foot	1		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Neuroarthropathy with ulcer with exposed bone.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary. Both are indicated.	Min
MRI foot with contrast	9	Radiographs and MRI are complementary. Both are indicated. See comments regarding contrast in the text below under "Anticipated Exceptions."	None
MRI foot without contrast	9	Radiographs and MRI are complementary. Both are indicated.	None
NUC Tc-99m 3-phase bone scan and In-111 WBC scan foot	4	If MRI contraindicated	High
NUC Tc-99m 3-phase bone scan foot	1		Med
NUC In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
NUC Tc-99m 3-phase bone scan and In-111 WBC scan and Tc-99m sulfur colloid marrow scan foot	1		High
CT foot without contrast	1		Min
US foot	1		None
FDG-PET	1		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Through the last 50 years there has been much written about the diabetic foot, with little consensus as to whether, when, and what imaging is appropriate. This overview will summarize some of the work and draw conclusions based on the available data. Several clinical situations will be discussed in which osteomyelitis or diabetic pedal disease is suspected, but clinical findings differ because of the presence or absence of edema ulceration and neuropathy.

Please note that although several of the variants have similar recommendations, they do present as unique clinical scenarios.

Soft-Tissue Edema without Ulceration

First, the probability of having osteomyelitis in a diabetic foot without evidence of ulceration is extremely low. Whether there is or is not soft-tissue swelling, these patients have almost no incidence of osteomyelitis and a low incidence of septic arthritis, but some frequency of soft-tissue infections. The only situation in which such a patient can have osteomyelitis is the presence of a "hidden" ulcer that has granulated over and may appear healed. In that situation the risk of osteomyelitis is still extremely low, since the ulcer would not have granulated over if osteomyelitis were present. Therefore, without a clinically apparent ulcer, the role of imaging might be to diagnose neuropathic disease or to see if there is soft-tissue infection only.

Neuropathy without Ulcer

A more difficult question is whether it is the neuroarthropathy or the soft-tissue infection that is causing the soft-tissue swelling. In a patient who has neuroarthropathy, the risk of infection is usually low without ulceration. Radiography can be used as a screening examination. Computed tomography (CT) may pick up neuroarthropathy, which may not be apparent radiographically and may be the cause of the swelling and pain (mimicking infection). CT can rarely exclude the diagnosis of osteomyelitis definitively if there is no edema in the marrow (fat is visible).

Scintigraphy is of indeterminate insensitivity and specificity, whether it is bone scan, indium or indium with sulfur colloid, or even positron emission tomography (PET). Flow images are the best discriminators of infection, but remain imperfect. Magnetic resonance imaging (MRI) likely has the best clinical results in this scenario with or without contrast, but the yield is going to be low in this clinical group of patients, and it is costly.

There is some importance in diagnosing neuropathic disease prior to radiographic changes, as these patients will be treated with altered footwear and orthotics to prevent the progression to deformity. Scintigraphy is, however, extremely sensitive to early neuropathic disease, long before radiographic changes are present. MRI is less sensitive but is a better test if there is a possibility of soft-tissue infection.

Ulcer with Exposed Bone

If an ulcer is present, the risk of infection is quite high, and almost invariable if the ulcer reaches bone. The role of imaging would be to confirm the infection and show extent. Radiography will show the infection, however late. Bone scan is quite nonspecific. Surprisingly, indium scan, even when combined with sulfur colloid marrow imaging, has low specificity, although if the ulcer is away from the joint these techniques are better. MRI has high specificity and sensitivity both with and without contrast. Ultrasound (US) may have promise in long bones but, to date, data about its utility in diagnosing the diabetic foot are quite limited. PET results are similarly poor, as this technique shows metabolic activity primarily and therefore is not specific.

Ulcer with Neuropathy and Exposed Bone

In patients who have diabetes and secondary neuroarthropathy, the infection is usually over an osseous abnormality with an ulcer. If the ulcer tracks down to bone, the risk of osteomyelitis is extremely high, perhaps even higher than in the preceding situation where there is an ulcer without neuropathic deformity. The overall role of imaging therefore, is more to determine the extent of the disease than to definitively diagnose it. Therefore, most authors do not advocate scintigraphy in this situation because of its relative poor spatial resolution for extent of disease; similar conclusions apply to PET.

Similarly, indium-labeled WBC (white blood cell) scanning with or without bone marrow scanning has only mixed sensitivity and specificity for osteomyelitis with neuropathy and yields poor anatomic extent of infection. Radiography has a high specificity but low sensitivity. US is unproven. CT will show the neuroarthropathic disease but not much else. MRI should be performed to determine extent of disease. T1 and fat-suppressed sequences are complementary, and contrast may or may not be used. The use of contrast is more to see the extent of the disease as well as the extent of vascularity, rather than to diagnose infections. Contrast may also help identify necrotic or poorly perfused regions, and to aid in surgical planning.

Summary and Recommendations

If a patient has an ulcer that extends to bone, there is quite likely, but not invariably, osteomyelitis. The best way to confirm this diagnosis and determine the extent of disease is with MRI. If there is no ulcer and there is still a clinical suspicion of infection, MRI is the test of choice. However, conventional radiographs should be done simultaneously in both situations. In indeterminate cases, aspiration and biopsy would be the next step.

If there is soft-tissue swelling the question is, "Is there early neuropathic disease or infection present?" Radiographs should be performed first. If the radiographs are normal, another test should be performed. If the suspicion of infection is low, the next test should probably be a three-phase bone scan. If there is a modest risk of infection, MRI is probably indicated.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF, also known as nephrogenic fibrosing dermopathy) was first identified in 1997 and has recently generated substantial

concern among radiologists, referring doctors and lay people. Until the last few years, gadolinium-based MR contrast agents were widely believed to be almost universally well tolerated, extremely safe and non-nephrotoxic, even when used in patients with impaired renal function. All available experience suggests that these agents remain generally very safe, but recently some patients with renal failure who have been exposed to gadolinium contrast agents (the percentage is unclear) have developed NSF, a syndrome that can be fatal. Further studies are necessary to determine what the exact relationships are between gadolinium-containing contrast agents, their specific components and stoichiometry, patient renal function and NSF. Current theory links the development of NSF to the administration of relatively high doses (e.g., >0.2mM/kg) and to agents in which the gadolinium is least strongly chelated. The U.S. Food and Drug Administration (FDA) has recently issued a "black box" warning concerning these contrast agents (http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm142882.htm).

This warning recommends that, until further information is available, gadolinium contrast agents should not be administered to patients with either acute or significant chronic kidney disease (estimated glomerular filtration rate [GFR] <30 mL/min/1.73m^2), recent liver or kidney transplant or hepatorenal syndrome, unless a risk-benefit assessment suggests that the benefit of administration in the particular patient clearly outweighs the potential risk(s).

Abbreviations

- CT, computed tomography
- FDG-PET, fluorodeoxyglucose-positron emission tomography
- In, indium
- Med, medium
- Min, minimal
- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- Tc, technetium
- US, ultrasound
- WBC, white blood cell

Relative Radiation Level	Effective Dose Estimated Range
None	0
Minimal	<0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate selection of radiologic imaging procedures for evaluation and diagnosis of patients with diabetes mellitus suspected of having osteomyelitis may lead to better patient outcomes.

POTENTIAL HARMS

- Recently some patients with renal failure who have been exposed to gadolinium contrast agents (the percentage is unclear) have developed nephrogenic systemic fibrosis (NSF), a syndrome that can be fatal. The U.S. Food and Drug Administration (FDA) has recently issued a "black box" warning concerning these contrast agents. This warning recommends that, until further information is available, gadolinium contrast agents should not be administered to patients with either acute or significant chronic kidney disease (estimated glomerular filtration rate [GFR] <30 mL/min/1.73m^2), recent liver or kidney transplant or hepatorenal syndrome, unless a risk-benefit assessment suggests that the benefit of administration in the particular patient clearly outweighs the potential risk(s).
- Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see "Availability of Companion Documents" field).

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should

dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Schweitzer ME, Daffner RH, Weissman BN, Bennett DL, Blebea JS, Jacobson JA, Morrison WB, Resnik CS, Roberts CC, Rubin DA, Seeger LL, Taljanovic M, Wise JN, Payne WK, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® suspected osteomyelitis in patients with diabetes mellitus. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 7 p. [22 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1995 (revised 2008)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Mark E. Schweitzer, MD; Richard H. Daffner, MD; Barbara N. Weissman, MD; D. Lee Bennett, MD; Judy S. Blebea, MD; Jon A. Jacobson, MD; William B. Morrison, MD; Charles S. Resnik, MD; Catherine C. Roberts, MD; David A. Rubin, MD; Leanne L. Seeger, MD; Mihra Taljanovic, MD; James N. Wise, MD; William K. Payne, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Alazraki N, Dalinka MK, Berquist TH, Daffner RJ, De Smet AA, el-Khoury GY, Goergen TG, Keats TE, Manaster BJ, Newberg A, Pavlov H, Haralson RH, McCabe JB, Sartoris D. Imaging diagnosis of osteomyelitis in patients with diabetes mellitus. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):303-10. [20 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

ACR Appropriateness Criteria® *Anytime*, *Anywhere*™ (PDA application). Available from the ACR Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria® radiation dose assessment introduction. American College of Radiology. 2 p. Electronic copies: Available from the ACR Web site.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This summary was updated by ECRI Institute on June 15, 2009.

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